Wilson Bull., 97(1), 1985, pp. 57–70

EVENING ROOSTS OF THE SNAIL KITE IN FLORIDA

PAUL W. SYKES, JR.

The wide-ranging Snail Kite (*Rostrhamus sociabilis*) of the New World uses communal night roosts, often in close association with herons and other colonial waterbirds (Bent and Job 1904, Howell 1932, Haverschmidt 1954, Brown and Amadon 1968). Little information has been published on kite roosting sites and roosting habits. In this paper I report on kite roost locations, size, frequency and range of use, time of arrivals and departures, types of habitats, and species associates at roosts in peninsular Florida.

METHODS

I observed evening roosts of the Snail Kite from 1968 through 1980, with the majority of the data collected between 1974 and 1980, primarily during annual Snail Kite censuses in November and December (Sykes 1979, 1982, 1983a). I initially located roost sites by following kites in late afternoon. Observations were generally made between 16:00 and 18:00, after which it was too dark to see the birds without artificial light. For each individual I recorded arrival time to the nearest minute, its plumage type (gray—adult and subadult males, brown—all females and immature males, and unknown—light conditions or distance prevented identification to plumage type; see Sykes [1979]), direction of arrival or departure, and whether or not it had a snail in its bill or had recently eaten as indicated by a distended crop.

Arrival times were standardized to minutes before and after sunset for Miami (U.S. Naval Observatory Nautical Almanac Office 1977) and grouped by plumage type and 5-min intervals before and after sunset. A few morning departure times were recorded. Sky conditions were recorded as either clear (less than 25% cloud cover) or cloudy (26–100% cloud cover).

The study areas are shown in Fig. 1 and roost sites in Figs. 2 and 3. Roosts at each locality were numbered separately, generally from north to south.

RESULTS AND DISCUSSION

Fifty-three percent of the 36 roosts (Figs. 2 and 3, Table 1) studied were in Conservation Area 3A (CA3A) where the major portion of the kite population has occurred during the last 10 years of the study (Sykes 1979, 1983a, b, 1984). Four (11%) of the roosts were occupied for 6 years or more, of which 20 (56%) also were used as nesting sites (Table 1). Most of the larger roosts were occasionally used during the day as loafing sites and feeding perches. The tendency of the species to move in response to changing habitat conditions (Sykes 1979, 1983a, b) perhaps explains why

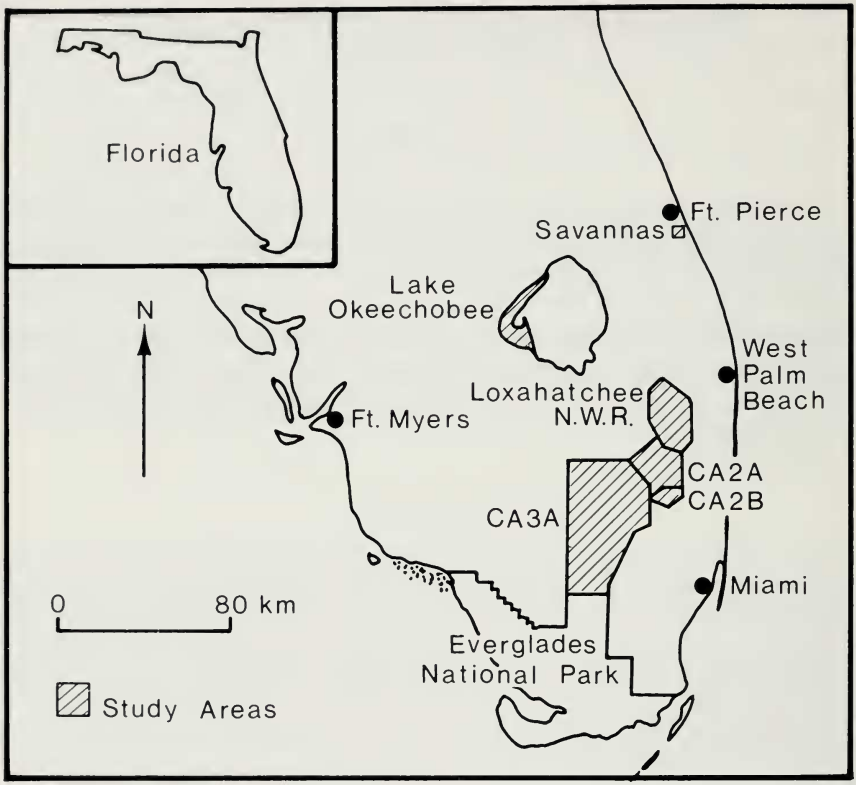

FIG. 1. Study areas in Southern Florida: the Savannas at Ft. Pierce (St. Lucie County); marshes on the west side of Lake Okeechobee (Glades County); and the Everglades (Loxahatchee National Wildlife Refuge [N.W.R.] [Palm Beach County]; Conservation Area 2A [CA2A] [Broward and Palm Beach counties]; Conservation Area 2B [CA2B] [Broward County]; and Conservation Area 3A [CA3A] [Broward and Dade counties]).

89% of the roosts were used for only 3 years or less. The number of kites using a roost varied from 2–85% year to year and ranged from 1 to 113 individuals (Table 1).

All roosts were located in flooded freshwater marshes. Thirty-three (91.6%) of the roosts were in stands of coastal-plain willow (*Salix caroliniana*), two (5.6%) were in stands of the introduced punk-tree (*Melaleuca quinquenervia*) (roost No. 6 in Conservation Area 2A [CA2A] and No. 2 in Conservation Area 2B [CA2B]), and one (2.8%) was in a stand of pond cypress (*Taxodium ascendens*) (roost No. 19 in CA3A). Roost sites were in trees or tall shrubs that formed taller distinctive vegetation units surrounded by low profile sedge-rush marshes of sawgrass (*Cladium jamai-*

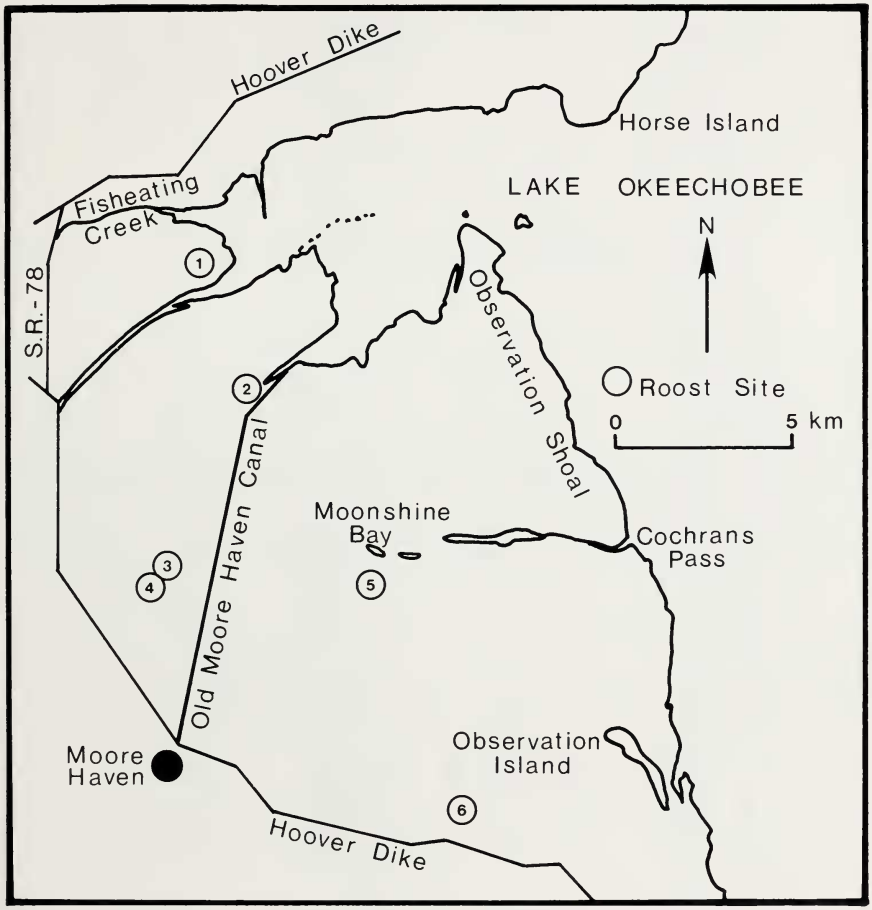

FIG. 2. Roost sites of the Snail Kite in the marshes on the west side of Lake Okeechobee.

censis), wet prairies, or aquatic white water-lily (*Nymphaea odorata*) slough communities.

Willow stands, which grow in thickets, clumps (Fig. 4), or elongated strands, were generally located on the berms around old alligator holes, burned-out peat pockets, former tree island sites, borders of tree islands, or disturbed areas along dikes. Loveless (1959) explains the terms and describes the plant communities. The heights of willows (N = 29) that kites used for roosting ranged from 1.8–6.1 m ($\bar{x}$ = 3.9, SD = 1.1), and the area of the stands ranged from 0.02–5 ha ($\bar{x}$ = 1.7, SD = 1.8). The interior of some willow stands had small openings (Fig. 5), while others were tangles of crooked leaning tree trunks and branches. Kites tended

TABLE 1

SNAIL KITE USE OF EVENING ROOSTS IN FLORIDA, 1968–1980

Roost locality	Roost no.	No. years roost checked	No. years used by kites	Number of individuals using each roost by plumage type												Also used for nesting
				Gray			Brown			Unknown			Total			
				Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	
Savannas	1	6	3	1			2	1	1.5 ± 0.70	0			3	1	2.0 ± 1.40	X
Lake	1	2	1	3			12			25			40			
Okeechobee	2	1	1	4			15			6			25			
	3 & 4	2	2	10	2	6 ± 5.66	36	12	24 ± 16.97	4			46	20	33 ± 18.38	
	5	1	6+	2			5			58			65			X
	6	2	3	21	6	13.5 ± 10.58	25	13	19 ± 8.48	69			88	46	67 ± 29.70	X
Everglades																
Loxahatchee	1	7	2	14	1	8 ± 4.98	7	2	4.3 ± 2.57	2			23	3	8.7 ± 6.87	X
N.W.R.	2	3	1	4			2			6			12			X
CA2A	1	1	1	5			8			0			13			X
	2	3	2	4	3	3.5 ± 0.71	6			0			10	9	9.5 ± 0.71	X
	3	3	2	10	8	9 ± 1.41	26	20	23 ± 4.24	0			34	30	32 ± 2.83	X
	4	3	2	8	4	6 ± 2.83	17	12	14.5 ± 3.46	0			25	16	20.5 ± 6.32	X
	5	3	1	5			15			0			20			X
	6	3	1	3			6			0			9			
CA2B	1	1	1	2			47			0			49			
	2	3	2	10	3	6.5 ± 4.90	49	34	41.5 ± 10.50	6			65	38	51.5 ± 19.08	
CA3A	1	3	1	3			3			0			6			X
	2	2	1	2			60			0			62			
	3	2	2	6			25	20	22.5 ± 3.46	0			31	20	25.5 ± 7.75	
	4	1	1	5			14			0			19			X
	5	1	1	0			1			0			1			
	6	1	1	4			9			0			13			X

TABLE 1
CONTINUED

Roost locality	Roost no.	No. years roost checked	No. years used by kites	Number of individuals using each roost by plumage type												Also used for nesting
				Gray			Brown			Unknown			Total			
				Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	Max.	Min.	$\bar{x} \pm SD$	
	7	6	6	12	6	7.8 ± 2.24	47	5	16.3 ± 15.64	7	1	4 ± 2.45	59	13	26.8 ± 17.04	X
	8	6	1	8			7			0			15			
	9	1	1	0			4			0			4			
	10	1	1	0			3			0			3			
	11	1	1	0			13			0			13			X
	12	1	1	0			0			4			4			
	13	1	1	0			1			0			1			
	14	2	1	4			3			3			10			X
	15	1	1	2			6			0			8			X
	16	1	1	1			1			1						
	17	6	6+	29	11	18.7 ± 7.22	78	5	27.7 ± 26.56	17	1	5.8 ± 6.18	113	17	52.2 ± 33.94	X
	18	7	6	16	2	10.2 ± 5.57	73	7	30.3 ± 27.42	8	1	2.5 ± 2.79	91	15	43 ± 30.07	X
	19	2	2	2			16	6	11 ± 7.07	0			16	8	12 ± 5.66	X

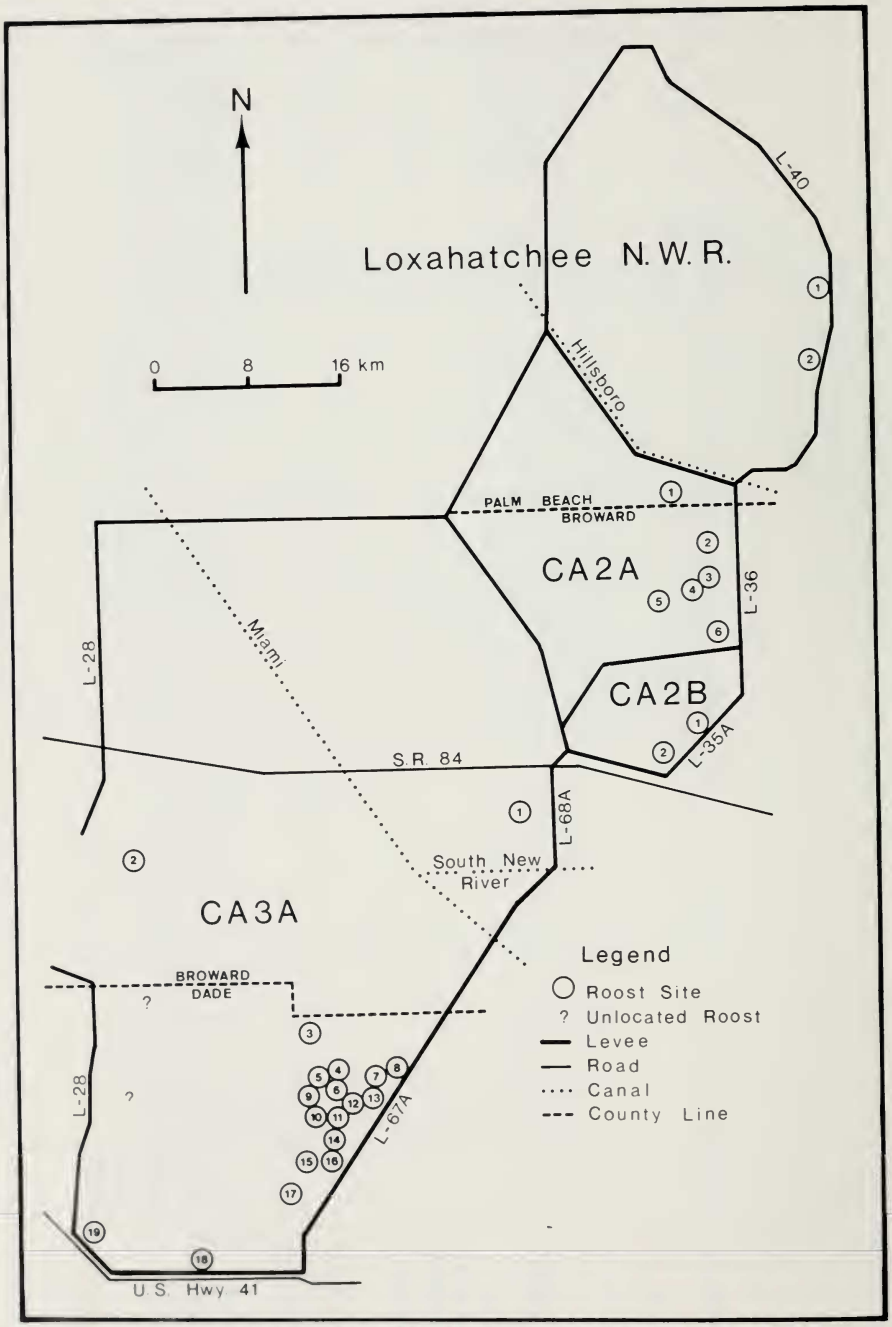

FIG. 3. Roost sites of the Snail Kite in the Everglades.

FIG. 4. Snail Kite roost No. 17 in southeastern CA3A in a large stand of coastal-plain willow. Dense sawgrass is in the foreground. Twelve Anhingas and 41 kites are in flight over the roost and 2 kites are perched to the right of center at the skyline.

to roost around the small openings if present in the stands. In larger stands roosting kites occupied a small area (roughly <10% of the stand). At the punk-tree and pond cypress roost sites the stands were no larger than 0.02 ha with tree heights that ranged from 4–12 m (N = 8, $\bar{x}$ = 8.9, SD = 3.8) and 4.8–8 m (N = 10, $\bar{x}$ = 6.3, SD = 1), respectively. The cypress roost was surrounded by taller trees and was the most "enclosed" of all the sites studied.

While most kites actively hunted immediately before going to roost, some went to the roost site and later departed to forage before returning for the night. This behavior was particularly associated with kites that had arrived at the roost early. In this study, 2–26% of the birds (N = 13 days of observations of 450 individuals, $\bar{x}$ = 0.09, SD = 0.08) arriving at roosts carried snails in their bills, a behavior pattern also reported for Snail Kites in South America (Haverschmidt 1954). Whole snails were usually brought to the roost, but on occasion they had been extracted from the shells. Gray birds brought food to roosts 14% of the time (N = 22) and brown birds 3% (N = 8); however, brown kites arrived with distended crops 46% of the time (N = 135), indicating they had recently fed.

FIG. 5. Inside view of Snail Kite roost No. 17 showing a small opening around an old alligator hole. The photograph was taken in mid-December when coastal-plain willows have dropped their leaves for a 2–3 week period. Ten kites are seen perched during the day.

The estimated heights at which kites flew to roosts ranged from 1.2–91 m ($N = 217$, $\bar{x} = 13.4$, $SD = 13.4$). On calm days or days with relatively light winds 70% of the birds flew to roost at heights of 4.6–30 m ($N = 147$, $\bar{x} = 18$, $SD = 14$). On windy days (winds >16 km/h) birds flying into the wind to the roost generally flew at 1.2–4.5 m ($N = 70$, $\bar{x} = 3.4$, $SD = 0.8$). This difference in the heights at which the kites flew on calm vs windy weather was highly significant ($t = 12.6$, $P < 0.001$).

Birds arriving at roosts came from all compass directions, but at some sites they appeared to follow specific corridors that tended to follow white water-lily aquatic slough systems.

Kites flew to roost singularly or in loose groups of two to four individuals. Upon arrival at the roost a bird usually would circle before alighting on a tree-top perch, exposed lower branch, or stub. At the roost individuals changed perches, called, sat quietly, preened, or scratched.

In the few cases ($N = 9$) where I could distinguish the sex and age of arriving birds by eye color, adult females tended to be dominant over both adult males and immatures and often would supplant them from their perches. Adult males would supplant other males and immatures. Individuals usually remained in the upper level of the roost for 10–30

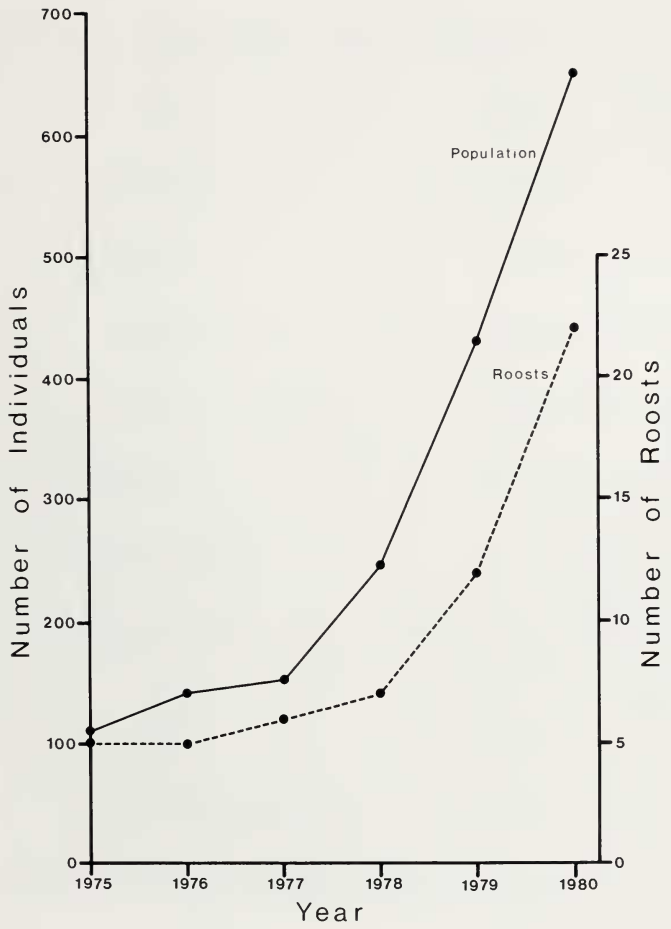

FIG. 6. Relationship of the number of roosts to the Snail Kite population increase, 1975–1980.

min before slowly moving to perches in the middle portion of the vegetation for the night and by darkness all birds had settled into this stratum. In the process of moving to the more sheltered part of the roost, the birds formed tighter groupings. The estimated spacing between roosting birds ranged from 0.3–6.5 m (N = 106, $\bar{x}$ = 0.8, SD = 0.8).

A strong correlation (r = 0.977, P = 0.002) exists between the increase in the kite population and number of roost sites during the 1975–1980 period (Fig. 6). As bird numbers increased during these years of higher water levels (Sykes 1983a), kites began to occupy more of their available

TABLE 2

SPECIES ASSOCIATES AT SNAIL KITE EVENING ROOSTS IN FLORIDA[a]

		% of visits on which species present[b]														
Locality	Roost number	Anhinga (*Anhinga anhinga*)	Great Egret (*Casmerodius albus*)	Snowy Egret (*Egretta thula*)	Little Blue Heron (*E. caerulea*)	Tricolored Heron (*E. tricolor*)	Cattle Egret (*Bubulcus ibis*)	Green-backed Heron (*Butorides striatus*)	Black-crowned Night-Heron (*Nycticorax nycticorax*)	Yellow-crowned Night-Heron (*N. violaceus*)	White Ibis (*Eudocimus albus*)	Glossy Ibis (*Plegadis falcinellus*)	Wood Stork (*Mycteria americana*)	Black Vulture (*Coragyps atratus*)	Turkey Vulture (*Cathartes aura*)	Total species
Savannas	1	X	50		33	33		66								5
Lake	1	X	X		X	X	50	50								6
Okeechobee	2	X			X	X	X	X								5
	3	X	X	X	X	X	X	X	X							8
	4	X	X	X	X	X	X	X	X							8
	5	X	X		X	X		X	X		X					7
	6	X	X	X	X	X	X	X	X		50					9
Loxahatchee	1		71	X	X	X	X		50		50	50				8
N.W.R.	2	X	X		X	66		66	X							6
CA2A	1		X		X	X	X	X								5
	2	X			33	33		33								4
	3	X	X	33	X	66		X	X							7
	4	X			66	66		33	33							5
	5	X	66	33	X	33		33	X							7
	6	X			66	33	33	33	X	X						7
CA2B	1	X		X	X	X	X	X								6
	2	X			33									X	X	4
CA3A	1	X	X	X	X	X		33	X							7
	2		X					33								2
	3	X														1

TABLE 2
CONTINUED[a]

Locality	Roost number	% of visits on which species present[b]															Total species
		Anhinga (*Anhinga anhinga*)	Great Egret (*Casmerodius albus*)	Snowy Egret (*Egretta thula*)	Little Blue Heron (*E. caerulea*)	Tricolored Heron (*E. tricolor*)	Cattle Egret (*Bubulcus ibis*)	Green-backed Heron (*Butorides striatus*)	Black-crowned Night-Heron (*Nycticorax nycticorax*)	Yellow-crowned Night-Heron (*N. violaceus*)	White Ibis (*Eudocimus albus*)	Glossy Ibis (*Plegadis falcinellus*)	Wood Stork (*Mycteria americana*)	Black Vulture (*Coragyps atratus*)	Turkey Vulture (*Cathartes aura*)	
	4	X	X		X	X											4
	5	X			X			33									3
	6	X	X		X	X											4
	7	X	X	83	X	X		X	X								7
	8	X			X	X											3
	9	X															1
	10																0
	11	X						50									2
	12	X															1
	13																0
	14	X															1
	15	X						X									2
	16																0
	17	X	X		X	X		66									5
	18	X	X	86	X	X		X	X		X						8
	19	X	X	X	X	X		50	50		X		X				9
% roosts	—	83	53	31	72	67	25	67	36	3	14	3	3	3	3	—	

[a] Not included: King Rail (*Rallus elegans*), Sora (*Prozana carolina*), Purple Gallinule (*Porphyrula martinica*), Common Moorhen (*Gallinula chloropus*), Limpkin (*Aramus guarauna*), and passerines as they were too inconspicuous to be recorded consistently while counting kites.
[b] X = 100%.

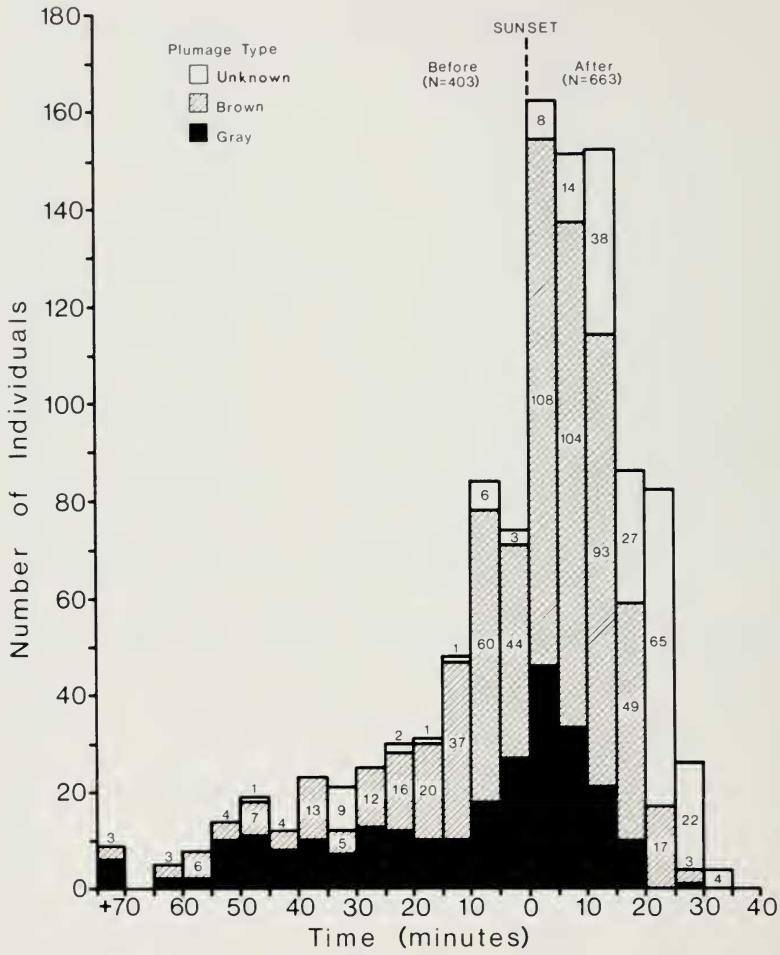

FIG. 7. Number of Snail Kites (N = 1066) arriving at roosts in relation to sunset by 5-min intervals. Numerals above and within the columns are the number of individuals by plumage type.

habitat and new roost sites were used. In 1980 only, kites were found to be roosting singly or in small groups in CA3A. At the same time the number of individuals using two of the larger roosts in CA3A (Nos. 7 and 17) decreased. This probably was a result of some kites that formerly used these roosts shifting to other sites.

The number of birds arriving at the roost before sunset was smaller (37.8%) than those arriving after sunset, and the arrival period was more protracted for early arrivals (Fig. 7). I found gray birds generally went to

roost earlier than brown birds (Mann-Whitney *U*-test, $t_u = 6.57$, $P < 0.001$). A possible reason for this was that brown birds included many immatures which are not as experienced at hunting as older birds and hence took more time to feed in late afternoon.

On cloudy days, when it got dark earlier, kites tended to arrive earlier at roosts, although the difference was not significant (one-tailed test, $t = 1.48$, $P = 0.07$). The mean arrival on cloudy days was 2.6 min before sunset (N = 185, SE = 1.3), as compared to 0.81 min after sunset (N = 673, SE = 0.8) on clear days.

Morning departures from roosts took place over much shorter periods than afternoon arrivals. The mean departure time before sunrise was 15.1 min (N = 13, SE = 1.14), with the earliest bird leaving 22 min before sunrise. The latest that birds left the roost in the morning was 3 min after sunrise. The sample size was insufficient to determine if kites left earlier or later on clear vs cloudy days. Before leaving the roost in the morning kites called, changed perches, made short flights within the roost, or flew around the roost site and returned.

Howell (1932:169) states that, "A colony of kites frequently locates not far from a rookery of herons." In my study I found herons and kites using the same roost sites 81% of the time; overall, 92% of the kite roosts in Florida had other kinds of birds using them, including 12 species of colonial waterbirds and both local species of vultures (Table 2). The three sites that had no other species associates were all extremely small (≤ 3 kites). The most frequent roost associates were Anhinga (83% of the roosts), Little Blue Heron (72%), Tricolored Heron (67%), and Green-backed Heron (67%). The kites roosted either among or off to the side of other communal birds, but within the same strata. Like kites these other species frequently used the roost sites for nesting.

SUMMARY

A total of 36 roost sites of the Snail Kite (*Rostrhamus sociabilis*) were studied in southern Florida, of which four (11%) were used regularly for 6 or more years. Major roosts were also used as nesting sites. All roosts were in flooded marshes and 33 (91.6%) were in stands of coastal-plain willow. Population increase and the number of roosts were strongly correlated. The number of kites arriving at roosts before sunset was smaller than arriving after sunset (37.8:62.2%), and gray birds (adult and subadult males) generally went to roost earlier than brown birds (all females and immature males). Kites tended to go to roost earlier on cloudy days. Morning departure from roosts was over a much shorter time than arrivals in the afternoon. Ninety-two percent of the kite roosts were also used by other species of birds for roosting, 81% of which were eight species of herons.

ACKNOWLEDGMENTS

I thank the many people who assisted me with the field work, and particularly W. J. Bolte, D. M. Cary, W. A. James, Sr., H. P. Langridge, J. A. Rodgers, J. C. Simmon, N. F. R.

Snyder, and J. E. Takekawa. L. J. Garrett and C. H. Plockelman were most helpful in locating references. Appreciation is expressed to G. L. Hensler and S. Mountainspring for guidance with the statistical analysis and to R. S. Kennedy, S. Mountainspring, J. M. Scott, and an unidentified reviewer for review of the manuscript.

LITERATURE CITED

Bent, A. C. and H. K. Job. 1904. (Letter describing a trip to Cape Sable, Florida and the upper keys in April and May 1903.) Auk 21:128–130.

Brown, L. and D. Amadon. 1968. Eagles, hawks and falcons of the world. Vol. 1. McGraw-Hill Book Co., New York, New York.

Haverschmidt, F. 1954. Evening flights of the Southern Everglade Kite and the Blue and Yellow Macaw in Surinam. Wilson Bull. 66:264–265.

Howell, A. H. 1932. Florida bird life. Florida Dept. Game and Fresh Water Fish, Tallahassee, Florida.

Loveless, C. M. 1959. A study of the vegetation of the Florida Everglades. Ecology 40: 1–9.

Sykes, P. W., Jr. 1979. Status of the Everglade Kite in Florida. Wilson Bull. 91:495–511.

———. 1982. Everglade Kite. Pp. 43–44 *in* CRC handbook of census methods for terrestrial vertebrates (D. E. Davis, ed.). CRC Press, Boca Raton, Florida.

———. 1983a. Recent population trend of the Snail Kite and its relationship to water levels. J. Field Ornithol. 54:237–246.

———. 1983b. Snail Kite use of the freshwater marshes of South Florida. Florida Field Nat. 11:73–88.

———. 1984. The range of the Snail Kite and its history in Florida. Bull. Florida State Mus., Biol. Sci. 29(6):211–264.

U.S. Naval Observatory Nautical Almanac Office. 1977. Table 1068, Miami. *In* Sunrise and sunset tables for key cities and weather stations of the United States. Gale Research Co., Detroit, Michigan.

U.S. FISH AND WILDLIFE SERVICE, PATUXENT WILDLIFE RESEARCH CENTER, SOUTHEAST FIELD STATION, SCHOOL OF FOREST RESOURCES, UNIV. GEORGIA, ATHENS, GEORGIA 30602. ACCEPTED 16 NOV. 1984.